Fact Sheet
June 2004

Managing Mercury Switches Found in Major Appliances

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

INFORMATION FOR SCRAP METAL RECYCLERS

DTSC is one of six Boards and Departments within the California Environmental Protection Agency. The Department's mission is to restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality, by regulating hazardous waste, conducting and overseeing cleanups, and developing and promoting pollution prevention.

State of California

California Environmental Protection Agency

This fact sheet is directed to people who handle and recycle discarded major appliances. It provides information about the requirements for removing and properly managing mercury switches before crushing or shredding an appliance.

What is mercury?

Mercury is a highly toxic substance that can cause birth defects, permanent brain damage, and even death through high level or prolonged exposure. Mercury can enter the body by being inhaled, absorbed through the skin, or eaten with contaminated food.

What are major appliances?

California Public Resources Code section 42166 defines a "**major appliance**" as "any domestic or commercial device, including, but not limited to, a washing machine, clothes dryer, hot water heater, dehumidifier, conventional oven, microwave oven, stove, refrigerator, freezer, air-conditioner, trash compactor, and residential furnace."

How is mercury used in major appliances?

Mercury's unique properties make it useful in appliances. Because mercury is a liquid at room temperature and a good conductor of electricity, it is often used in tilt switches that control motors and pumps. In this application, mercury is contained inside a small capsule connected to two electrodes. Depending on the position of the capsule (for instance, whether a washing machine lid is open or closed) the mercury will complete or break the circuit between the electrodes.

Mercury expands when heated, making it useful in flame sensors for gas stove pilot lights. In this application, mercury is placed inside a capillary tube close to the pilot light. If the pilot light goes out, the mercury cools and contracts, closing the gas safety valve.

What statutes and regulations apply to mercury switches in major appliances?

In 1991 the California Legislature enacted Assembly Bill 1760 (Chapter 849, Statutes of 1991), which required that hazardous materials and hazardous wastes

be removed before discarded major appliances are crushed or shredded for recycling (Pub. Resource Code § 42175). In 1997 the Legislature enacted AB 847 (Stats. 1997, ch. 884), specifying "mercury contained in switches and temperature control devices" among the materials that must be removed from appliances (Pub. Resource Code § 42167). In 2001, the Legislature clarified, in Senate Bill (SB) 633 (Stats. 2001, ch. 656), that any person who fails to remove mercury switches or any other specified hazardous material from a major appliance before it is crushed or shredded is in violation of the State's hazardous waste laws.

In March 2003, the Department of Toxic Substances Control (DTSC) adopted the Mercury Waste Classification and Management (MWCM) regulations. These regulations affect people who handle discarded appliances that contain mercury switches in two important ways:

1. Before the MWCM regulations, mercury switches were fully regulated as hazardous waste. Under the MWCM regulations, mercury switches are now regulated as universal waste, a subcategory of hazardous waste that uses simple, streamlined handling requirements. Universal waste management requirements differ significantly from the standard requirements for hazardous waste generators, transporters, and storage facilities.

2. At present, mercury switches by themselves fail the state's hazardous waste tests for mercury. However, major appliances are not considered hazardous waste unless the amount of mercury in their switches, as a percentage of the weight of the entire appliance, exceeds a hazardous waste threshold. However, beginning February 9, 2006, the MWCM regulations will designate mercury switches and products that contain them (including major appliances) as hazardous waste, regardless of their mercury concentration (Cal. Code Regs., tit. 22, § 66261.50, listing M002).

For more information on the MWCM regulations, please refer to the following documents on DTSC's Web site:

- Fact sheet: *Managing Universal Waste in California*, http://www.dtsc.ca.gov/PublicationsForms/HWM_FS_UWR.pdf
- Fact sheet: *Changes to California's Universal Waste Regulations*, http://www.dtsc.ca.gov/HazardousWaste/Mercury/HWMP_FS_UWRChanges.pdf
- Summary tables: *Summary of Universal Waste Handler Requirements*, http://www.dtsc.ca.gov/HazardousWaste/Mercury/HWM_REP_UW-Requirements.pdf

Who will be affected?

Scrap metal recyclers who accept discarded major appliances will be affected by the new regulations because they are usually the last businesses to handle the appliances before they are crushed and shredded. A scrap metal recycler is a used appliance dealer, an appliance recycler, a scrap metal yard, or any other entity that handles a major appliance after it has reached the end of its useful life.

Although the Public Resources Code does not specify who should remove mercury-containing switches, it does require that mercury-containing switches be removed from any major appliance before it is crushed for transport or transferred to a baler or shredded for recycling. People who crush or shred major appliances must either ensure that mercury-containing switches and other materials that require special handling are removed from major appliances before they take possession of the appliance or be prepared to remove and properly manage the materials themselves. [In addition to mercury switches, state law (Pub. Resources Code § 42175) requires that encapsulated polychlorinated biphenyls (PCBs), chlorofluorocarbons (CFCs), and used oil be removed from major appliances. These materials are not affected by the designation of mercury-containing switches as a universal waste.]

Which major appliances contain mercury switches?

Mercury switches can be found in some chest freezers, washing machines, gas ranges, space heaters, commercial gas water heaters, furnaces and boilers, gas refrigerators, and gas air conditioners. Among other

appliances that typically contain mercury switches are the following.

- **Chest Freezers** that have convenience lights in their lids may contain mercury tilt switches. All manufacturers stopped using mercury switches in freezers as of January 1, 2000.
- **Washing Machines** that do not have a plastic tab mechanism in the lid that acts as a switch for power are likely to contain a mercury switch. Some washing machines built before the 1980s may contain mercury switches.
- **Gas Ranges, Ovens, and Stoves** that have continuously burning pilot lights in the broiler section will contain mercury flame sensors. Ovens that have lights that turn on when the door is opened may have mercury tilt switches. Some of the major brand names of gas ranges, ovens and stoves from the 1960s to the present might contain mercury.
- **Electric or Gas Space Heaters** may contain mercury switches and/or flame sensors.
- **Commercial Gas Water Heaters** that are 100 gallons or larger may contain a mercury thermocouple instead of an electronic flame sensor. Smaller (residential) gas and electric water heaters do not contain mercury.
- **Other Residential and Commercial Appliances** including furnaces and boilers, gas refrigerators, gas air conditioners, dryers, and microwave ovens may have thermoelectric switches that contain mercury.

Major brand names for these appliances are listed in Appendix A, which is attached. Unfortunately, there is no comprehensive list of all the makes and models of major appliances that contain mercury switches. Appendix A, however, lists some of the major appliances that generally contain mercury switches and flame sensors.

When is the best time to remove switches from discarded major appliances?

Switches should be removed by the scrap metal recycler as soon as the appliance is received, preferably at the same time as any CFCs or PCBs are removed.

Only those people who are properly trained and equipped to remove, handle, and manage recovered switches should attempt to remove any mercury switch from any major appliance.

Provided they do not generate other hazardous wastes, people who never accumulate 11,000 pounds of universal waste at any time need not obtain a U.S. Environmental Protection Agency (EPA) Identification number. However, these "small quantity handlers" are subject to several other requirements. They must:

- have a mercury clean-up system in place;
- thoroughly train employees who remove mercury switches in proper handling and emergency procedures, and
- keep records on mercury switch removal on file for at least three years.

It is important to note that appliance recyclers who generate fully regulated hazardous waste in addition to universal waste are not relieved of their legal obligation. They must maintain an EPA Identification Number and meet other requirements of handling any hazardous wastes removed from appliances that are not universal wastes.

Where are mercury switches located and how are they removed?

For information on the location of mercury switches in major appliances and detailed instructions for removing them, please refer to DTSC's *Self-Training Manual for Removing Mercury Switches from Major Appliances*, available on the Internet at www.dtsc.ca.gov.

The time and difficulty involved in removing mercury switches depends on the type and condition of the appliance. Some switches can be removed in one minute; others may take as long as one hour. For example, removing the mercury switch from a gas stove will take longer than removing one from a washing machine because of the type of switch and its location. Rusty screws, stripped heads, grease, rodent nests, and fragile switches will also affect the removal process.

How much mercury are we talking about?

The amount of mercury contained inside a single switch varies with the type of switch. A single switch in a chest freezer typically contains 1 to 1.5 grams (one to two drops) of mercury. A single switch in a gas stove, washing machine, or commercial water heater contains approximately 2.5 grams (approximately two drops) of mercury.

How should mercury switches be managed after removal?

Mercury switches are universal waste, a category of hazardous waste that may be managed under simple, streamlined requirements. Persons who remove and manage mercury switches from major appliances are regulated as universal waste handlers. The requirements for universal waste handlers are found in article 2 of chapter 23 of the California Code of Regulations, title 22. For a summary of the requirements for handlers of mercury switches, please refer to the fact sheet, "Managing Universal Waste in California" on DTSC's Web site at www.dtsc.ca.gov/PublicationsForms/HWM_FS_UWR.pdf, as well as the *Self-Training Manual for Removing Mercury Switches from Major Appliances* discussed above.

Disclaimer

This fact sheet was prepared in June 2004 and is based on the statutes and regulations in effect at that time. You should always review the most current statutes and regulations. Mention of product names in this fact sheet is not to be construed as an endorsement of that product.

For more information

For specific information about mercury and mercury switch management, and information about regulatory requirements, please contact one of DTSC's Public and Business Liaisons using the contact information provided at right. For general information about mercury and mercury switches, you may also contact:

U.S. EPA - RCRA, Superfund & EPCRA Call Center at 800-424-9346 or www.epacallcenter@bah.com

U.S. EPA at www.epa.gov/mercury/

U.S. EPA-Region 5 at www.epa.gov/region5/air/mercury/mercury.html

Association of Municipal Recycling Coordinators at www.amrc.guelph.org/

Appliance Recycling Information Center at www.aham.org/aric/aric.cfm

APPENDIX A
Manufacturers/Models Of Major Appliances That Contain Mercury Switches

Table 1 – Tilt Switches

Appliance Type	Manufacturer/Brand	Year	Switch Location
Chest Freezers	Amana	Pre-2000	Light socket in lid
	Baycrest		
	Beatty		
	Belwood		
	Bradford		
	Cdn. Appliance Manu.		
	Continental		
	Coronado		
	Deep Freeze		
	Derby/Denby		
	FHH8		
	Franklin		
	Frigidare		
	GE*		
	General Freezer		
	Hotpoint		
	Kelvinator		
	Kenmore		
	McCleary		
	McGraw-Edison		
	Montgomery Ward		
	Norseman		
	RCA		
	Sears Coldspot		
	Simpson Sears		
	Supreme		
	Viking		
	Westinghouse		
	Wood		
	Zenith		
Washing Machines	Kenmore	Pre-1990, mounted to arm on lid concealed under cover (left side) for spin cycle in 1980s. Also dynamic stabilizing system pre-1972	
	Maytag		
	RCA Whirlpool		

*New models of these appliances also may contain mercury switches.

Sources:

Guide for Identifying Mercury in Household Applications. Burlington Board of Heath. December 2000.

Mercury Switches in Appliances: Final Report. Prepared for Massachusetts Department of Environmental Protection by Franklin County Solid Waste Management District.

Ontario White Goods Collection & Mercury Switch/Sensor Removal Pilot – Final Report. Association of Municipal Recycling Coordinators. Prepared for Environment Canada. March 2002.

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Table 2 – Flame Sensor or Safety Valve*

Appliance Type	Manufacturer/Brand	Switch Location
Ranges/Ovens/ Stoves With or Without Electric Connections		
	Cholson/Colson	Front of broiler
	Coloric	Rear of burner
	GE	Rear of broiler
	Glenwood	Rear of broiler
	Magee	Rear of broiler
	Magic Chef	Broiler burner
	Preway	Burner
	Sears	Rear of broiler
	Whirlpool	Rear of broiler
Gas Ranges w/Space Heater	Coloric	Heater burner
	Magee	
Space Heaters	Presto	Inside bottom
	Thermo Pride	On burner
Commercial Water Heaters	GE	On burner
	Rheem	On burner
Furnaces & Boilers	Thermo Pride	On burner
	White Rodgers	
Gas Refrigerators	All except Norcold 1082, 600, 900, 1200	On burner
Gas Air Conditioners		

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